WHAT IS CLAIMED IS:

1. A method for controlling traffic of downstream data to be transmitted from an OLT (Optical Line Termination) to ONUs (Optical Network Units) in an EPON (Ethernet Passive Optical Network) including an ODN (Optical Distribution Network) connected to the OLT and a plurality of the ONUs connected to a plurality of subscribers, said method comprising the steps of:

a) generating individual tokens respectively for the ONUs based on individual transfer rates allocated respectively to the ONUs;

b), classifying the downstream data based on the data's destination ONU, and then storing the downstream data in transmission buffers which correspond respectively to the ONUs;

c) selecting one of the transmission buffers, and checking whether there is downstream data awaiting transmission stored in the selected buffer;

d) determining whether the downstream data can be transmitted based on individual token information, previously stored, for an ONU corresponding to the downstream data; and

e) calculating a service rate of the corresponding ONU according to the transmission result, and storing the calculated service rate.

2. The method as set forth in claim 1, wherein step a) further includes storing the individual tokens while classifying them according to the ONUs.

3. The method as set forth in claim 1, further includes the steps of:

f) generating a common token based on a total transfer rate of the EPON and then storing the common token;

g), if it is determined at the step d) that the downstream data cannot be transmitted

based on the individual token information, determining whether the downstream data can be transmitted based on information of the common tokens;

h), if it is determined at the step g) that the downstream data can be transmitted based on the common token information, transmitting the downstream data, and changing the common token information according to the transmission result.

4. The method as set forth in claim 1, further comprising the step of:

i), if it is determined at the step d) that the downstream data can be transmitted based on the individual token information, transmitting the downstream data, and then calculating the service rate of the corresponding ONU after changing the individual token information of the corresponding ONU according to the transmission result.

5. The method as set forth in claim 4, wherein all the transmission buffers corresponding respectively to the ONUs connected to the EPON are selected one by one in a round robin scheme.

6. The method as set forth in claim 3, wherein, at the step b), the common token is generated to have the same value as a sum of all the individual tokens generated at the step a).

7. The method as set forth in claim 1, wherein the step e) includes the steps of:

e-1) comparing a volume of data stored in each of the transmission buffers with a volume of data transmittable by an individual token for a corresponding one of the ONUs; and

e-2) determining that said data stored in each of the transmission buffers can be transmitted, if the compared result of the step e-1) is that said volume of data stored in each of the transmission buffers is smaller than or equal to said volume of data transmittable by

the individual token.

8. The method as set forth in claim 3, wherein the step f) includes the steps of:

f-1) determining whether the number of common tokens is larger than or equal to a minimum guaranteed token number, and whether a service rate of the corresponding ONU for a predetermined past period of time satisfies a predetermined condition; and

f-2), if it is determined at the step f-1) that the number of common tokens is larger than or equal to the minimum guaranteed token number and the service rate of the corresponding ONU for the predetermined past period of time also satisfies a condition expressed by the following inequality, determining that the corresponding downstream data can be transmitted by the common token:

$$\frac{(\text{contracted max. rate for } ONU_i) - (ONU_i\text{'s service rate for predetermined past period})}{(\text{contracted max. rate for } ONU_i) - (\text{contracted average rate for } ONU_i)} \geq rand(0,1)$$

where "ONU_i" denotes the corresponding ONU.

9. The method as set forth in claim 1, wherein, at the step h), an average length of downstream data serviced to each of the ONUs for a predetermined period of time is calculated as a downstream data service rate of said each of the ONUs.

10. The method as set forth in claim 4, wherein, at the step i), an average length of downstream data serviced to each of the ONUs for a predetermined period of time is calculated as a downstream data service rate of said each of the ONUs.

11. An apparatus for controlling traffic of downstream data to be transmitted from an OLT (Optical Line Termination) to ONUs (Optical Network Units) in an EPON (Ethernet Passive Optical Network) including an ODN (Optical Distribution Network) connected to the OLT and a plurality of the ONUs connected to a plurality of subscribers, said apparatus comprising:

a packet classifier for classifying downstream data according to its destination ONU;

a first packet processor for determining whether downstream data can be transmitted based on the individual token information previously stored for an ONU corresponding to the downstream data;

a packet transmitter for receiving downstream data to be transmitted to each of the ONUs from the first packet processor, and converting the downstream data into an EPON frame, and then multiplexing and outputting the downstream data after attaching address information of the corresponding ONU; and

a second packet processor for temporarily storing a downstream data signal output from the packet transmitter, and transmitting the downstream data signal to a corresponding ONU through a downstream link connected to the corresponding ONU.

12. The apparatus as set forth in claim 11, further comprising:

a common token information manager for managing common token information according to a total transfer rate of the EPON; and

the first packet processor further determining whether downstream data can be transmitted based on common token information.

13. The apparatus as set forth in claim 12, wherein the second packet processor further changes the common token information based on the transmission result and transfers the changed result to the common token information manager.

14. The apparatus as set forth in claim 11, wherein the first packet processor includes:

an individual token generator for generating an individual token for a corresponding ONU according to a transfer rate that has been allocated to the corresponding ONU based on an established contract;

an individual token storage for storing the individual token for the corresponding ONU generated by the individual token generator;

a transmission buffer for temporarily storing downstream data to be transmitted to the corresponding ONU;

a first transmission controller for determining whether the downstream data can be transmitted based on individual token information of the corresponding ONU, and, if this determination result is negative, determining whether the downstream data can be transmitted based on common token information; and

a service rate meter for measuring a data transfer rate or a service rate of a corresponding ONU for a predetermined period of time under control of the first transmission controller.

15. The apparatus as set forth in claim 14, wherein the individual token generator generates a predetermined number of tokens corresponding to a transfer rate allocated to the corresponding ONU, and a predetermined number of tokens corresponding to a minimum guaranteed transfer rate.

16. The apparatus as set forth in claim 14, wherein the first transmission controller compares a volume of downstream data stored in the transmission buffer with a volume of data transmittable by the individual token information, and determines that the downstream data can be transmitted by the individual token information, if the compared result is that said volume of downstream data stored in the transmission buffer is smaller than or equal to

said volume of data transmittable by the individual token information.

17. The apparatus as set forth in claim 14, wherein the first transmission controller receives the common token information from the common token information manager, and determines whether the number of common tokens previously stored is larger than or equal to a minimum guaranteed token number, and whether a service rate of the corresponding ONU for a predetermined past period of time satisfies a condition expressed by the following inequality, and then, if it is determined that said number of common tokens previously stored is larger than or equal to the minimum guaranteed token number and the service rate also satisfies the condition expressed by the following inequality, determines that the downstream data can be transmitted by the common token:

$$\frac{(\text{contracted max. rate for } ONU_i) - (ONU_i\text{'s service rate for predetermined past period})}{(\text{contracted max. rate for } ONU_i) - (\text{contracted average rate for } ONU_i)} \geq rand(0,1)$$

where "ONU_i" denotes the corresponding ONU.

18. The apparatus as set forth in claim 14, wherein the first transmission controller changes the individual token information stored in the individual token storage, based on the result of the downstream data transmission by the individual token information.

19. The apparatus as set forth in claim 14, wherein an average length of downstream data serviced to each of the ONUs for a predetermined period of time is calculated, by the service rate meter, as a downstream data service rate of said each of the ONUs.

20. The apparatus as set forth in claim 12, wherein the second packet processor includes:

an integrated buffer for storing downstream data that has been determined at the first packet processor to be transmittable by the individual token information and the common token information and then transferred to the integrated buffer through the packet transmitter;

a common token storage for storing the common token information as token information corresponding to a transfer rate allocated to the EPON; and

a second transmission controller for transmitting the downstream data stored in the integrated buffer to a corresponding ONU, and changing the common token information stored in the common token storage based on the transmission result.